004266

Contract # 0690025

STATE OF UTAH CONTRACT

1. CONTRACTING PARTIES: This contract is between the following agency of the State of Utah:
Department: Utah Department of Transportation Agency Code: 810 Division: Traffic Operation Center, referred to as (STATE), and the following CONTRACTOR:

Precision Solar Control Inc.		
Name		
2985 Market Street		
Address		
Garland	TX	75041
City	State	Zip

LEGAL STATUS OF CONTRACTOR
- ☐ Sole Proprietor
- ☐ Non-Profit Corporation
- ☒ For-Profit Corporation
- ☐ Partnership
- ☐ Government Agency

Contact Person Mike Merrell Phone #972-278-0553 Email mmerrell@precisionsolarcontrols.com
Federal Tax ID# 75-2312461 Vendor #112688A Commodity Code #80178000000

2. GENERAL PURPOSE OF CONTRACT: The general purpose of this contract is to provide:
Provide Dynamic Curve Warning LED Sign-System

3. PROCUREMENT: This contract is entered into as a result of the procurement process on RX# 810 56000000102, FY2005, Bid#GL5035-1 or a pre-approved sole source authorization (from the Division of Purchasing) #: SSN/A.

4. CONTRACT PERIOD: Effective date: 05/25/05 Termination date: 05/24/07 unless terminated early or extended in accordance with the terms and conditions of this contract. Renewal options (if any): Two (2) one-year renewal options

5. CONTRACT COSTS: CONTRACTOR will be paid a maximum of $Requirememts - See Bid for costs authorized by this contract. Additional information regarding costs: requirements, see bid

6. ATTACHMENT A: Division of Purchasing's Standard Terms and Conditions
ATTACHMENT B: Scope of Work
ATTACHMENT C: Special Terms & Conditions
ATTACHMENT D: Pricing
Any conflicts between Attachment A and other Attachments will be resolved in favor of Attachment A.

7. DOCUMENTS INCORPORATED INTO THIS CONTRACT BY REFERENCE BUT NOT ATTACHED:
a. All other governmental laws, regulations, or actions applicable to the goods and/or services authorized by this contract.
b. Utah State Procurement Code, Procurement Rules, and CONTRACTOR'S response to Bid #GL5035-1 dated 03/29/05.

IN WITNESS WHEREOF, the parties sign and cause this contract to be executed.

CONTRACTOR

Contractor's Signature — Date: Oct. 17, 2005

DAVID WILTONG VICE PRESIDENT
Type or Print Name and Title

STATE

Agency's Signature — Date: 18 Aug 05

Director, Division of Purchasing — Date: NOV 07 2005

Director, Division of Finance

LaDonna Haslem	(801) 965-4068	(801) 965-4073	lhaslem@utah.gov
Agency Contact Person	Telephone Number	Fax Number	Email

(Revision 09/30/2003)

REC'D DEC 01 2005

ATTACHMENT A: STATE OF UTAH STANDARD TERMS AND CONDITIONS

1. **AUTHORITY:** Provisions of this contract are pursuant to the authority set forth in 63-56, Utah Code Annotated, 1953, as amended, Utah State Procurement Rules (Utah Administrative Code Section R33), and related statutes which permit the State to purchase certain specified services, and other approved purchases for the State.

2. **CONTRACT JURISDICTION, CHOICE OF LAW, AND VENUE:** The provisions of this contract shall be governed by the laws of the State of Utah. The parties will submit to the jurisdiction of the courts of the State of Utah for any dispute arising out of this Contract or the breach thereof. Venue shall be in Salt Lake City, in the Third Judicial District Court for Salt Lake County.

3. **LAWS AND REGULATIONS:** Any and all supplies, services and equipment furnished will comply fully with all applicable Federal and State laws and regulations.

4. **RECORDS ADMINISTRATION:** The Contractor shall maintain, or supervise the maintenance of all records necessary to properly account for the payments made to the Contractor for costs authorized by this contract. These records shall be retained by the Contractor for at least four years after the contract terminates, or until all audits initiated within the four years, have been completed, whichever is later. The Contractor agrees to allow State and Federal auditors, and State Agency Staff, access to all the records to this contract, for audit and inspection, and monitoring of services. Such access will be during normal business hours, or by appointment.

5. **CONFLICT OF INTEREST:** Contractor represents that none of its officers or employees are officers or employees of the State of Utah, unless disclosure has been made in accordance with 67-16-8, Utah Code Annotated, 1953, as amended.

6. **CONTRACTOR, AN INDEPENDENT CONTRACTOR:** The Contractor shall be an independent contractor, and as such, shall have no authorization, express or implied, to bind the State to any agreements, settlements, liability, or understanding whatsoever, and agrees not to perform any acts as agent for the State, except as herein expressly set forth. Compensation stated herein shall be the total amount payable to the Contractor by the State. The Contractor shall be responsible for the payment of all income tax and social security amounts due as a result of payments received from the State for these contract services. Persons employed by the State and acting under the direction of the State shall not be deemed to be employees or agents of the Contractor.

7. **INDEMNITY CLAUSE:** The Contractor agrees to indemnify, save harmless, and release the State OF UTAH, and all its officers, agents, volunteers, and employees from and against any and all loss, damages, injury, liability, suits, and proceedings arising out of the performance of this contract which are caused in whole or in part by the negligence of the Contractor's officers, agents, volunteers, or employees, but not for claims arising from the State's sole negligence.

8. **EQUAL OPPORTUNITY CLAUSE:** The Contractor agrees to abide by the provisions of Title VI and VII of the Civil Rights Act of 1964 (42USC 2000e) which prohibits discrimination against any employee or applicant for employment or any applicant or recipient of services, on the basis of race, religion, color, or national origin; and further agrees to abide by Executive Order No. 11246, as amended, which prohibits discrimination on the basis of sex; 45 CFR 90 which prohibits discrimination on the basis of age; and Section 504 of the Rehabilitation Act of 1973, or the Americans with Disabilities Act of 1990 which prohibits discrimination on the basis of disabilities. Also, the Contractor agrees to abide by Utah's Executive Order, dated March 17, 1993, which prohibits sexual harassment in the work place.

9. **SEPARABILITY CLAUSE:** A declaration by any court, or any other binding legal source, that any provision of this contract is illegal and void shall not affect the legality and enforceability of any other provision of this contract, unless the provisions are mutually dependent.

10. **RENEGOTIATION OR MODIFICATIONS:** This contract may be amended, modified, or supplemented only by written amendment to the contract, executed by the same persons or by persons holding the same position as persons who signed the original agreement on behalf of the parties hereto, and attached to the original signed copy of the contract.

11. **DEBARMENT:** The Contractor certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction (contract), by any governmental department or agency. If the Contractor cannot certify this statement, attach a written explanation for review by the State. The Contractor must notify the State Director of Purchasing within 30 days if debarred by any governmental entity during the Contract period.

12. **TERMINATION:** Unless otherwise stated in the Special Terms and Conditions, this contract may be terminated, with cause by either party, in advance of the specified termination date, upon written notice being given by the other party. The party in violation will be given ten (10) working days after notification to correct and cease the violations, after which the contract may be terminated for cause. This contract may be terminated without cause, in advance of the specified expiration date, by either party, upon 90 days prior written notice being given the other party. On termination of this contract, all accounts and payments will be processed according to the financial arrangements set forth herein for approved services rendered to date of termination.

13. **NONAPPROPRIATION OF FUNDS:** The Contractor acknowledges that the State cannot contract for the payment of funds not yet appropriated by the Utah State Legislature. If funding to the State is reduced due to an order by the Legislature or

the Governor, or is required by State law, or if federal funding (when applicable) is not provided, the State may terminate this contract or proportionately reduce the services and purchase obligations and the amount due from the State upon 30 days written notice. In the case that funds are not appropriated or are reduced, the State will reimburse Contractor for products delivered or services performed through the date of cancellation or reduction, and the State will not be liable for any future commitments, penalties, or liquidated damages.

14. **SALES TAX EXEMPTION:** The State of Utah's sales and use tax exemption number is E33399. The tangible personal property or services being purchased are being paid from State funds and used in the exercise of that entity's essential functions. If the items being purchased are construction materials, they will be converted into real property by employees of this government entity, unless otherwise stated in the contract.

15. **WARRANTY:** The contractor agrees to warrant and assume responsibility for all products (including hardware, firmware, and/or software products) that it licenses, contracts, or sells to the State of Utah under this contract for a period of one year, unless otherwise specified and mutually agreed upon elsewhere in this contract. The contractor (seller) acknowledges that all warranties granted to the buyer by the Uniform Commercial Code of the State of Utah apply to this contract. Product liability disclaimers and/or warranty disclaimers from the seller are not applicable to this contract unless otherwise specified and mutually agreed upon elsewhere in this contract. In general, the contractor warrants that: (1) the product will do what the salesperson said it would do, (2) the product will live up to all specific claims that the manufacturer makes in their advertisements, (3) the product will be suitable for the ordinary purposes for which such product is used, (4) the product will be suitable for any special purposes that the State has relied on the contractor's skill or judgment to consider when it advised the State about the product, (5) the product has been properly designed and manufactured, and (6) the product is free of significant defects or unusual problems about which the State has not been warned. Remedies available to the State include the following: The contractor will repair or replace (at no charge to the State) the product whose nonconformance is discovered and made known to the contractor in writing. If the repaired and/or replaced product proves to be inadequate, or fails of its essential purpose, the contractor will refund the full amount of any payments that have been made. Nothing in this warranty will be construed to limit any rights or remedies the State of Utah may otherwise have under this contract.

16. **PUBLIC INFORMATION:** Contractor agrees that the contract will be a public document, and may be available for distribution. Contractor gives the State express permission to make copies of the contract and/or of the response to the solicitation in accordance with the State of Utah Government Records Access and Management Act. The permission to make copies as noted will take precedence over any statements of confidentiality, proprietary information, copyright information, or similar notation.

17. **DELIVERY:** Unless otherwise specified in this contract, all deliveries will be F.O.B. destination with all transportation and handling charges paid by the Contractor. Responsibility and liability for loss or damage will remain with Contractor until final inspection and acceptance when responsibility will pass to the State except as to latent defects, fraud and Contractor's warranty obligations.

18. **ORDERING AND INVOICING:** All orders will be shipped promptly in accordance with the delivery schedule. The Contractor will promptly submit invoices (within 30 days of shipment or delivery of services) to the State. The State contract number and/or the agency purchase order number shall be listed on all invoices, freight tickets, and correspondence relating to the contract order. The prices paid by the State will be those prices listed in the contract. The State has the right to adjust or return any invoice reflecting incorrect pricing.

19. **PAYMENT:** Payments are normally made within 30 days following the date the order is delivered or the date a correct invoice is received, whichever is later. All payments to the Contractor will be remitted by mail unless paid by the State of Utah's Purchasing Card (major credit card).

20. **PATENTS, COPYRIGHTS, ETC.:** The Contractor will release, indemnify and hold the State, its officers, agents and employees harmless from liability of any kind or nature, including the Contractor's use of any copyrighted or un-copyrighted composition, secret process, patented or un-patented invention, article or appliance furnished or used in the performance of this contract.

21. **ASSIGNMENT/SUBCONTRACT:** Contractor will not assign, sell, transfer, subcontract or sublet rights, or delegate responsibilities under this contract, in whole or in part, without the prior written approval of the State.

22. **DEFAULT AND REMEDIES:** Any of the following events will constitute cause for the State to declare Contractor in default of the contract: 1. Nonperformance of contractual requirements; 2. A material breach of any term or condition of this contract. The State will issue a written notice of default providing a ten (10) day period in which Contractor will have an opportunity to cure. Time allowed for cure will not diminish or eliminate Contractor's liability for damages. If the default remains, after Contractor has been provided the opportunity to cure, the State may do one or more of the following: 1. Exercise any remedy provided by law; 2. Terminate this contract and any related contracts or portions thereof; 3. Impose liquidated damages, if liquidated damages are listed in the contract; 4. Suspend Contractor from receiving future solicitations.

23. **FORCE MAJEURE:** Neither party to this contract will be held responsible for delay or default caused by fire, riot, acts of God and/or war which is beyond that party's reasonable control. The State may terminate this contract after determining such delay or default will reasonably prevent successful performance of the contract.

24. **PROCUREMENT ETHICS:** The Contractor understands that a person who is interested in any way in the sale of any supplies, services, construction, or insurance to the State of Utah is violating the law if the person gives or offers to give any compensation, gratuity, contribution, loan or reward, or any promise thereof to any person acting as a procurement officer on behalf of the State, or who in any official capacity participates in the procurement of such supplies, services, construction, or insurance, whether it is given for their own use or for the use or benefit of any other person or organization (63-56-1002, Utah Code Annotated, 1953, as amended).

25. **CONFLICT OF TERMS:** Contractor Terms and Conditions that apply must be in writing and attached to the contract. No other Terms and Conditions will apply to this contract including terms listed or referenced on a Contractor's website, terms listed in a Contractor quotation/sales order, etc. In the event of any conflict in the contract terms and conditions, the order of precedence shall be: 1. State Standard Terms and Conditions; 2. State Additional Terms and Conditions; 3. Contractor Terms and Conditions.

(Revision date: July 5, 2005)

ATTACHMENT B

SECTION 1.0 DETAILED TECHNICAL SPECIFICATIONS

This section describes the technical specifications that apply to the Dynamic Curve Warning LED Variable Message Sign (VMS) with radar speed detection. Note that within these specifications, the term Variable Message Sign or VMS shall be identical to the NTCIP/NEMA definition of a Dynamic Message Sign (DMS) and is intended to identify any sign that can receive and display text dynamically from a local memory or a remote system.

1.1 General Scope

This specifies the requirements for equipment, and materials of the VMS to be furnished. A VMS shall include:

1.1.1 A VMS sign assembly complete with all electrical and mechanical components in accordance with these specifications.

1.1.2 A local controller complete with all the necessary protection devices and appurtenances required to provide a fully operable system.

1.1.3 All incidental equipment, materials, wiring, conduit, cabling, testing, and work to provide a complete and accepted VMS.

1.1.4 All software for the VMS components and software for the laptop computer used for operation and diagnostics via the local control port at the VMS control cabinet.

1.1.5 An integrated radar unit for speed detection.

1.2 VMS Configuration (Full Matrix)

The VMS shall be "full matrix". Larger displays than shown below are acceptable as long as the other minimum and maximum standards are met. VMS that marginally exceed standards will be considered at the discretion of the Ordering Agency. The following table lists the key characteristics of the VMS:

The VMS shall have a continuous matrix display of minimum 48 pixel columns wide by minimum 25 pixel rows high per line (1200 total pixels). Each pixel shall be made from either a single or group of amber light emitting diodes and contain no moving parts. A LED display module shall contain a minimum of 25 LED pixels. All LED display modules, assemblies, and components shall be identical, individually replaceable, and interchangeable throughout the VMS. Signs shall have the following parameters:

1.2.1 Equal horizontal and vertical pixel spacing, center to center and gap between pixels.

1.2.2 The VMS controller and display unit shall be a single self-contained integrated unit. Normal setup, diagnostics, and maintenance of the sign shall be capable of being performed without removing the sign from its support mounting. Internal sign components shall be accessible through an access door that is not impeded by the support structure for the sign.

1.2.3 12 Inch Character VMS

1.2.3.1: Pixel spacing shall be such that seven pixels in height shall be 12 inches.

1.2.3.2: The total weight of the VMS shall not exceed 1,350 pounds.

1.2.3.3: The maximum power requirement of the VMS shall not exceed 1,875 watts.

1.2.4 18 Inch Character VMS

1.2.4.1: Pixel spacing shall be such that seven pixels in height shall be 18 inches.

1.2.4.2: The total weight of the 18 Inch Character VMS shall not exceed 1,600 pounds.

1.2.4.3: The maximum power requirement of the VMS shall not exceed 2,500 watts.

1.3 Human Engineering

To the highest practicable degree, the unit shall be engineered for simplicity and ease of operation and maintenance. Unless otherwise noted, all replaceable parts of the VMS shall be removable and installable with the use of standard hand tools. This shall include the following:

1.3.1 Fuses - All fuses shall be easily accessible and shall be replaceable without the use of any tools;

1.3.2 Printed Circuit Boards - PCBs shall slide smoothly in their guides while being inserted into or removed from the frame and shall fit snugly into the plug-in PCB connectors. PCBs shall require a force no less than 5 pounds or greater than 20 pounds for insertion or removal;

1.3.3 Controls - All controls shall be clearly labeled as to their functions;

1.3.4 The VMS equipment, components, and housing shall be designed and constructed for ease of maintenance. A single technician shall be able to remove and replace any modular assembly under adverse conditions in under 15 minutes. All electronic subassemblies subject to failure shall be easily replaced by using plug-in or fully connectorized

subassemblies. Any required configuration jumpers shall be clearly marked.

1.4 Design Engineering

The following practices shall be employed in the design of solid-state equipment circuitry:

1.4.1 Compensation - The design shall be inherently temperature compensated to prevent abnormal operation. The circuit design shall include such compensation as is necessary to overcome adverse effects due to temperature in the specified environmental range.

1.4.2 Dangerous Voltage - For reasons of personal safety, personnel shall be protected from all dangerous voltages.

1.4.3 Surge Suppression – The power is protected from surges by an UltraFax suppressor good for 600 joules of surge energy absorption and 48,000 amps. The AC to DC power supply has "Crowbar Overvoltage protection to prevent overvoltage surges from damaging connected equipment. "Data is protected with the same UltraFax Surge Suppressor. If external surge suppression is used to mitigate transient voltage most typically seen from lightening strikes on civil infrastructure protection in the form of surge suppression between the VMS and the local controller is not necessary.

1.5 VMS Materials Provisions

1.5.1 General:

1.5.1.1: Use of vacuum or gaseous tubes or electro-mechanical devices within the equipment is not acceptable unless specifically noted within these Specifications.

1.5.1.2: The bidder shall include information regarding the use of all sole sourced and custom components with their bid.

1.5.1.3: If EPROMs, PLAs, ROMs, or other programmable devices are used, sufficient documentation shall be supplied to allow the DEPARTMENT to acquire the device directly from the device manufacturer or distributor.

1.5.1.4: The electronic circuit design shall be such that all components of the same generic type, regardless of manufacturer, shall function similarly in accordance with the specifications.

1.5.1.5: Any component, which may be loosened due to vibration, shall be properly secured with hold down brackets, retainers or other means.

1.5.1.6: All damaged or defective components shall be replaced as per these Specifications.

1.5.1.7: Integrated circuits (IC's) are not socket mounted. The IC's are soldered directly into the circuit thereby eliminating corrosion issues that could cause an open circuit which is the danger of a socket and IC style design.

1.5.1.8: No component shall be operated above 80 percent of its maximum rated voltage, current, or power ratings. Digital components shall not be operated above 3 percent of their nominal voltage, current, or power ratings.

1.5.1.9: No component shall be provided for which the manufactured date is two years older than the contract award date. The design life of all components shall be a minimum of 10 years of continuous operation.

1.5.1.10: Except as specified above, all discrete components, such as resistors, capacitors, diodes, transistors, optical isolators, triacs, and integrated circuits shall be individually replaceable.

1.5.1.11: Components shall be arranged so they are easily accessible for testing.

1.5.1.12: Where applicable, all components shall meet UL standards.

1.5.2 Capacitors

1.5.2.1: The DC and AC voltage ratings as well as the dissipation factor of a capacitor shall exceed the worst-case design parameters of the circuitry by 150 percent.

1.5.2.2: A capacitor, which may be damaged by shock or vibration, shall be properly supported by a clamp or fastener.

1.5.2.3: Capacitor encasements shall be resistant to cracking, peeling, and discoloration.

1.5.2.4: All capacitors shall be insulated and shall be marked with their capacitance values and working voltages.

1.5.3 Resistors

1.5.3.1: All resistors shall be insulated and shall be marked with their resistance values. Resistance values shall be indicated by the EIA color codes, or stamped value (power resistor).

1.5.3.2: Resistors shall have five percent or less tolerance.

1.5.3.3: The value of the resistors shall not vary by more than five percent between -34 degrees and 74 degrees C.

1.5.3.4: Resistors that have a rating exceeding two watts shall not be used unless special ventilation or heat sinking is provided. They shall be insulated from the PCB.

1.5.4 Semiconductor Devices

1.5.4.1: All solid-state devices, except LEDs, shall be of the silicon type.

1.5.4.2: All transistors, integrated circuits, and diodes shall be a standard type listed by EIA and clearly identifiable.

1.5.5 Transformers and Inductors

1.5.5.1: All power transformers and inductors shall have the manufacturer's name or logo and part number clearly and legibly printed on the case or laminations.

1.5.5.2: All transformers and inductors shall have their windings insulated and shall be protected to exclude moisture.

1.5.5.3: All transformer and inductor leads shall be color coded with an approved EIA color code or identified in a manner to facilitate proper installation.

1.5.5.4: Where custom transformers are used, the CONTRACTOR shall provide complete specifications and fabrication information sufficient to allow the transformer to be acquired directly from the component manufacturer or from alternative sources.

1.5.6 Circuit Breakers

1.5.6.1: Circuit breakers shall be listed by UL or ETL. The trip and frame sizes shall be plainly marked on the breaker by the manufacturer, and the ampere rating shall be visible from the front of the breaker. All circuit breakers 20 amperes or greater shall be quick-break on either automatic or manual operation. Contacts shall be silver alloy and enclosed in an arc-quenching chamber. Overload tripping shall not be influenced by an ambient air temperature range of from -18 degrees to 50 degrees C. Minimum interrupting capacity shall be 10,000 amperes, RMS.

1.5.6.2: Circuit breakers shall be trip free type.

1.5.6.3: Multi-pole circuit breakers shall be the common trip type.

1.5.7 Switches

The switch contacts shall be rated for a minimum of 5-ampere resistive load at 120 VAC or 28 VDC and shall be gold over brass (or equal). The switch shall be rated for a minimum of 100,000 no-load operations.

1.5.8 Terminal Blocks

Unless otherwise noted, the blocks shall be barrier type rated at 20 amperes, 600 VAC RMS minimum. The terminal screws shall be 0.3125-inch minimum length nickel-plated brass binder head type with screw inserts of the same material.

1.5.9 Wiring, Cabling, and Harnesses

1.5.9.1: All electrical conductors shall be copper.

1.5.9.2: Harnesses shall be properly bundled and tie-wrapped with external protection and strain relief.

1.5.9.3: Each harness shall be of adequate length to allow any harness or conductor to be connected to or disconnected from its associated connector or termination point without stress to any conductor, harness or connector.

1.5.9.4: Harnesses shall be neat, firm, and routed to minimize crosstalk and electrical interference.

1.5.9.5: Ribbon cables shall only be used where they are not subjected to strain during normal operations or maintenance. All ribbon cable connectors shall employ ejection type sockets.

1.5.9.6: Wiring containing AC shall be bundled separately or shielded separately from all DC logic voltage control circuits.

1.5.9.7: Wiring shall be routed to prevent conductors from being in contact with metal edges. Wiring shall be arranged so that any removable assembly may be removed without disturbing conductors not associated with that assembly.

1.5.9.8: All wiring, cabling and harnesses shall terminate in connectors or on terminal blocks.

1.5.9.9: All removable assemblies shall be connectorized and shall not require that any wires be removed, cut, soldered, or spliced to remove a serviceable assembly or subassembly.

1.5.9.10: All wire shall conform to MIL 16878D Type B Vinyl - nylon jacket or THHN, stranded conductors.

1.5.9.11: Printed Circuit Boards (PCB)

1.5.9.12: There are no contacts on PCB's in VMS design.

1.5.9.13: PCB design shall be such that components may be removed and replaced without damage to boards, traces, or tracks.

1.5.9.14: Fabrication of PCBs shall be in compliance with Military Specification: MIL-P-13949, except as follows:

1.5.9.14.1: Only NEMA FR-4 glass cloth base epoxy resin copper clad laminates 0.0626-inch minimum thickness shall be used. Intercomponent wiring shall be by laminated copper clad track having a minimum weight of two ounces per square foot with adequate cross section for the current to be carried. All copper track shall be plated or soldered to provide complete coverage of all exposed copper track. Jumper wires will not be permitted, except from plated-through padded holes to an external component or for designed function selection with the jumper insulated and as short as possible.

1.5.9.14.2: Section 3.3.3 of Military Specification: MIL-P-13949E shall read "Pits and Dents. Grade of Pits and Dents shall be of Grade B quality (3.3.3.2) or better."

1.5.9.14.3: Section 3.3 of Military Specification: MIL-P-13949 shall be omitted.

1.5.9.14.4: Section 3.4 of Military Specification: MIL-P-13949 shall read "Warp or Twist. Class of permissible warp or twist shall be Class A (Table II) or better."

1.5.9.14.5: Sections 4.2 through 6.6 of Military Specification: MIL-P-13949 (inclusive) shall be omitted except as referenced in previous sections of this specification.

1.5.9.14.6: The fabrication of PCBs and the mounting of parts and assemblies thereon shall conform to Military Specification: MIL-STD-275E, except as follows:

1.5.9.14.7: All semiconductor devices required to dissipate more than 250mW or any case temperature that is 10 degrees Celsius above ambient shall be mounted with spacers or transipads to prevent direct contact with the PCB.

1.5.9.14.8: When completed, all residual flux shall be removed from the PCB.

1.5.9.14.9: All PCBs that are not coated are contained within a housing that is contained within the control console. All PCB's within the interior housing are oriented to reduce moisture. The housing within a housing method is very effective for reducing or eliminating corrosion on PCB's boards due to moisture. Coating is not necessary.

1.5.9.14.10: Where less than 0.25 inch lateral separation is provided between the PCB (or the components of a PCB) and any metal surface, a 0.03125 (-0.0 to +0.0156) inch thick Mylar (polyester) plastic cover or equivalent shall be provided on the metal to protect the PCB.

1.5.10 The PSC Permanent Message board is an extremely low powered system. Power usage will be less than that used to light a typical 150 watt light bulb. Current carrying capacity of the traces on the circuits have a factor of safety many times that is necessary for the actual current being carried. Fusing on the system is located in the battery box for solar systems with a resetable breaker and on the power supply for AC systems.

1.5.11 Soldering: Hand soldering shall comply with Military Specification: MIL-P-55110.

1.5.12 Automatic flow soldering shall conform to the following conditions:

1.5.12.1: Constant speed conveyor system.

1.5.12.2: Conveyor speed shall be the optimum to minimize solder peaks or points, which form at component terminals.

1.5.12.3: Temperature shall be controlled to within ±8 degrees C of the optimum temperature.

1.5.12.4: The soldering process shall result in the complete coverage of all copper runs, joints, and terminals with solder except that which is covered by an electroplating process.

1.5.12.5: Wherever clinching is not used, a method of holding the components in the proper position for the flow process shall be provided.

1.5.12.6: If exposure to the temperature bath is of such time-temperature duration as to come within 80 percent of any components maximum specified time-temperature exposure, that component shall be hand soldered to the PCB after the flow process has been completed.

1.5.13 Definitions: Definitions for the purpose of this section on PCBs shall be taken from MIL-STD-429 and any current addendum.

1.5.14 Assemblies and PCB Design: All assemblies shall be easily replaceable and incorporate plug-in capability for their associated devices or PCBs.

1.5.15 Assemblies shall be provided with a minimum of two guides for each plug-in PCB or associated device (except relays). The guides shall extend to within 0.75 inch from the face of either the socket or connector and front edge of the assembly. If nylon guides are used, the guides shall be securely attached to the file or assembly chassis.

1.5.16 No components, traces, brackets or obstructions shall be within 0.125 inch of the board edge (guide edges).

1.5.17 The manufacturer's name or logo, model number, serial number, and circuit issue or revision number shall appear and be readily visible.

1.5.18 The mounting and choice of components shall ensure that PCBs are not damaged or discolored due to the heat generated either individually or collectively by the components.

1.6 Light Emitting Diodes (LEDs)

1.6.1 LED Pixels

1.6.1.1: Each LED shall be encapsulated to provide environmental protection. The LEDs shall be un-tinted, non-diffused, solid-state LED using Agilent Technologies aluminum indium gallium phosphide (AlInGaP) technology or equivalent technology. Agilent Technologies latest product, AlInGaP II LEDs or equivalent, are required unless the STATE approves an alternate. The LEDs shall encompass multiple monochrome amber that shall emit at a wavelength of 592 nm and T-1 ¾ size. Each pixel shall have equal color and on-axis intensity.

1.6.1.2: Viewing angle - 18" character – 11.5 degrees Vertical / 33 Degrees Horizontal. 12" character – 30 degrees circular cone.

1.6.1.3: All LED clusters are rectangular clusters or four LEDs.

1.6.1.4: Pixel spacing: 18" characters – 2.66" center to center 12" characters – 1.5" center to center.

1.6.1.5: The 12 inch characters formed by the "on" pixels shall be readable from any point on the approach roadway up to 600 feet away under all weather and lighting conditions. The 18 inch characters formed by the "on" pixels shall be readable from any point on the approach roadway up to 900 feet away under all weather and lighting conditions.

1.6.1.6: Each pixel is made up of one continuous string of four LED's. The typical failure mode for an LED is to open up. If the LED opens up all of the LED's in the Pixel will go out. If a malfunction occurs it will not result in a miss spelling or loss of the message.

1.6.1.7: LED pixel forward voltage drop, measured from the DC power supply output to ground, shall not exceed 24 VDC. This shall include the drive circuit voltage drop and any internal DC line loss.

1.6.1.8: Pixels and modules shall be aligned such that there is no visible difference in illumination between pixels within the same modules or in different modules. Minor measured differences shall be allowed if visible differences are undetectable.

1.6.1.9: Each LED cluster shall be rated for outdoor usage over environmental range expected for the sign locations (including heat absorption and heat absorption due to sunlight). All materials used in the fabrication of the LED clusters shall not be damaged by direct exposure to sunlight. Each pixel shall be rated for 100,000 hours of operation under field operating conditions without 30% degradation in optical power output.

1.6.2 Electrical requirements for LED Pixels

1.6.2.1.1: The unit is designed to minimize junction temperatures via recommendations from the LED manufacturer, we have not conducted LED junction temperature testing. Manufacturers of the LED's specify the thermal environment that the LED can safely operate in to reach the reliability and life expectancy level covered by their warranty. As with any part on in the VMS it is expected that PSC design the product within these parameters. The LED's used in the VMS have specifications that state the ambient temperature that they can withstand and the drive current that can be allowed at that temperature without damaging the LED's. These design criteria are as follows for the LED's used in the VMS – Max operating temperature 100 degrees Celsius. Max LED drive current at 100 degrees Celsius 20 mA. The PSC VMS has an effective forward current through each LED in the on state of 20 mA. Therefore the maximum temperature they can be exposed to at that drive current is 100 degrees Celsius. The Maximum ambient temperature recorded in a message board display in Texas on a hot summer day under full solar loading is 71 degrees Celsius. Therefore thermal loading is not as much of an issue as the current at which PSC drives the LED's which is

less than 40% of the max drive current of 50 mA.

1.6.2.1.2: All exposed metal on both sides of the LED driver circuit board, except power and signal connectors, shall be protected from water and humidity exposure by a thorough application of silicone-based coating.

1.6.2.1.3: LED drive circuitry shall support a minimum refresh rate of 10 frames per second.

1.6.2.1.4: Removal or failure of a single driver circuit board shall not affect the performance of any LED display module in the VMS, except the module that it drives.

1.6.3 LED Pixel Circuit Boards

1.6.3.1: Each pixel shall have a device that protects the LEDs.

1.6.3.2: Each pixel shall consist of one or more strings of discrete LEDs, and each LED string shall be in series with its own current limiting resistor. Current limiting resistor shall be rated to prevent LED forward current from exceeding 30 mA to maximize LED service life. The failure of an LED string shall not cause a change in the forward current of any other LED string in the VMS. The failure of an LED string shall not cause a change of any other LED string or pixel in the VMS, and failure of a pixel shall not cause the failure of any other pixel in the VMS.

1.6.3.3: All LED pixel circuit boards shall be identical and interchangeable throughout the VMS.

1.6.4 LED Display Modules

1.6.4.1: The Character panels are one entire panel. If a Pixel goes out the entire modal will be replaced. The Driver board shall require either basic hand tools or no tools for removal and replacement.

1.6.4.2: LED display module electrical and signal connections shall be the quick-disconnect locking connector type.

1.6.4.3: Removal of a single display module from the VMS, or failure of a single module, shall not affect the performance of any other module in the sign. Removal of one or more modules shall not affect VMS structural integrity or the structural integrity of the rest of the LED display matrix.

1.6.4.4: Display modules shall mount to the inside of the front face panels using either standard hand tools or no tools for removal and replacement. The display modules shall be capable of being replaced by a single technician in five minutes or less under adverse conditions. Display modules shall be similar hardware for ease of replacement.

1.6.4.5: All display modules, as well as the LED pixel boards, driver circuit boards and daughter boards, shall be identical and interchangeable.

1.6.5 LED Module Mounting

1.6.5.1: The front face of the 18" character sign is angled down slightly to deflect headlight and sun glare, aiding in the legibility in most conditions. The characters are mounted parallel to the read mounting structure of the sign cabinet.

1.6.5.2: VMS Display

Only in the NTCIP remote mode does the display allow 4 x 7 font, and options for different character spacing.

1.6.5.2.1: Separation between the last column of one module and the first column of the next shall be equal to the horizontal distance between the columns of a single display module.

1.7 VMS Sign Face

1.7.1 The sign shall be designed to ensure that the front face does not fog or discolor during sign operation. Further, the sign shall be designed to allow a single technician to clean the inside of the sign face less than 1 hour.

1.7.2 Polycarbonate LED Covering: Signs shall have polycarbonate or equivalent material covering the LED Pixels and pixel boards. The polycarbonate or equivalent covering shall be weather tight, ultraviolet protected, non-diffusing, 0.125 to 0.250-inch thick. Polycarbonate resin shall meet or exceed the standards met by Lexan® PC Resin for impact strength, transparency, purity, consistency, durability, heat resistance, flame resistance, and UV stability.

1.7.3 Reflective light: the18" character signs the window is mounted at a downward angle to prevent reflection, the 12" character sign has a diffused/matte finish polycarbonate sheet to disperse glare and reflection. Both of these methods have been field proven to reduce or eliminate dangerous reflective light from the message face. Pixel openings shall be of sufficient size as to not interfere with LED light output. Sign face shall be designed to minimize bowing.

1.7.4 The front face shall be rated for high-pressure washing using a power washer producing working pressure of 600 PSI and 1.8 GPM.

1.8 VMS Mechanical Provisions

1.8.1 Connectors

1.8.1.1: All connectors shall be keyed to prevent improper insertion of the wrong connector or PCB.

1.8.1.2: The mating connectors shall be designated as the connector number and male/female relationship such as CAP (plug or PCB edge connector) and CAS (socket).

1.8.1.3: Connectors shall be of a standard manufacturer with quick connect/disconnect capability.

1.8.1.4: The PCB receptacle connector shall meet or exceed the following:

1.8.1.4.1:	Operating voltage:	600VAC (RMS) at sea level
1.8.1.4.2:	Insulation Resistance:	5,000 megohms
1.8.1.4.3:	Contact Material:	There are 4 connectors in this area. Three of these have gold plating. The fourth connector is used to supply power to the board and uses tin plating.
1.8.1.4.4:	Contact Resistance:	0.006 ohm maximum

1.8.1.5: All PCB connectors mounted on a motherboard shall be mechanically secured to the chassis or frame of the unit.

1.8.1.6: All screw type fasteners shall utilize locking devices or locking compounds except for finger screws, which shall be captive.

1.8.1.7: Dimensions: All dimensions shall be in inches. The following tolerances shall apply unless otherwise specifically stated in these Specifications:

1.8.1.7.1:	Sheet Metal	0.0525 inch
1.8.1.7.2:	PCB	+0, -0.010 inch
1.8.1.7.3:	Edge Guides	0.015 inch

1.8.1.8: Hardware: Unless otherwise noted, all hardware used in electronic assemblies shall be corrosion resistant stainless steel.

1.9 VMS Controller

1.9.1 General

1.9.1.1: The VMS controller shall include a watchdog timer for detecting controller failure and resetting the microprocessor. Functions such as plan storage and communications with the VMS central control facility software will be conducted by software resident in the controller unit. The unit shall be capable of providing electrical isolation, monitoring of sign status, detection of failed elements and other features particular to the sign design.

1.9.1.2: The VMS controller shall include a rechargeable battery backup power supply or super capacitor that shall maintain the internal clock and all memory for a minimum of 10 days without power. The battery technology used shall have a minimum serviceable life of 5 years in the circuit and a minimum of 5-year shelf life.

1.9.1.3: The VMS controller unit shall store a minimum of 32 two-phase messages of 24 characters per phase in RAM and a minimum of 32 two-phase messages of 24 characters per phase in non-volatile memory.

1.9.1.4: The VMS controller unit shall operate from a nominal 120 VAC, 60 Hz power supply, and from a 12 VDC solar power with battery backup. The DEPARTMENT shall have the option at the time of ordering either type of power. The entire sign system will run using grid power. The operating voltage will 120 VAC 60 Hz. The maximum possible current draw at 120 VAC will be 605 amps AC. The maximum wattage possible will be 741 watts. The nominal daytime running current will be 1.2 amps AC. The nominal daytime running wattage will be 140 watts.

1.9.1.5: The VMS controller unit shall include a front mounted power on/off switch that shuts down the power, regardless of the type of power. The switch shall be mechanical to protect it from accidental shut off.

1.9.1.6: The VMS controller unit and its associated software shall meet all of the functional requirements of the VMS Specification and fully support the NTCIP protocol stack.

1.9.1.7: The VMS controller shall be integrated with the radar unit, such that the VMS can display a specific message based on the speed detected by the radar, and that the speed can be displayed as part of the message. The speed output from the radar unit shall be mapped to the "DmsCurrentSpeed" MIB object.

1.10 VMS Light And Temperature Sensors

Each VMS shall be provided with a system that shall sense the background ambient light level and provide a minimum of seven field-adjustable intensities (dimming).

1.10.1 The dimming system utilizes one photocell which views the rear of the sign on the 18" character unit, and the front of the sign on the 12" character unit. In the event that the photocell fails, the sign brightness output moves to a point of 50% of the highest possible brightness. 50% of the highest possible brightness is the nominal brightness for typical daytime usage based on temperature and input voltage. The message board would continue to adjust brightness based on input voltage and ambient temperature.

1.10.2 The dimming system circuitry shall select one of seven levels from either the sensed ambient light when operating in local mode or from commands sent from the central control system, when operating in remote mode. The dimming system shall be capable of sending readings from all photocells (255 levels each) to the central control system. Based on these photocell readings, the central control system will make a determination of the appropriate sign intensity level. This intensity level, which runs from 1 to 7, will then be downloaded to the sign controller, where the controller shall adjust the signs brightness appropriately. The download intensity level will not affect or cause a "blanked" VMS to energize its LEDs.

1.10.3 The dimming circuit and VMS power system shall have electrical devices installed to minimize RFI noise generated by the VMS both on the power line and radiated by sign circuitry.

1.10.4 Alternative dimming systems will be considered for approval by the DEPARTMENT.

1.10.5 Each VMS shall be provided with a sensor that only measures the internal component.

1.11 VMS Housing

General Requirements: Housings shall have interior non-corrosive metal cage support frames to mount the display elements. The cage support frame shall be designed to withstand and minimize vibrational effects to the display and/or electronic elements.

The VMS housing shall meet all wind loading requirements as specified in the DEPARTMENT's Structures Design Guidelines.

1.11.1 The VMS housing shall be designed such that the VMS can be shipped and temporarily stored without damage or undue stresses prior to installation on the support structure.

1.11.2 All VMS housings shall be constructed to present a clean, neat appearance. Housing shall protect internal components from rain, ice, dust, and corrosion in accordance with NEMA enclosure Type 3R standards, as described in NEMA Standards Publication 250-1997, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.11.3 Housings shall be fabricated from 0.090 inch (minimum) aluminum. The housing body and inside framework shall be permanently attached to form a single unit designed to withstand 80 pounds per square foot as specified in the AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals,* most recent edition, and NCHRP *Report 412, Fatigue-Resistant Design of Cantilevered Signal, Sign, and Light Supports.* Alternative housing structures can be submitted for review and approval by the Evaluation Committee.

1.11.4 The Housing should contain no fewer than 2 Aluminum I-Beams. A standard UDOT sign support will be used and the Aluminum I-Beams will be adequate.

1.11.5 All surfaces shall be free of dents, scratches, burrs, weld burns, or abrasions. The manufacturer's ID plate is mounted on the outside of the sign cabinet.

1.11.6 All sharp edges and corners shall be rounded.

1.11.7 Welding: All exterior seams shall be continuously welded and each weld shall be uniform flow. All welds shall be neatly formed and free of cracks, blowholes, and other irregularities. Welding on aluminum housings shall be done by gas metal arc (MIG) or gas tungsten arc (TIG) process using bare aluminum welding electrodes. The electrodes shall conform to the requirements of the American Welding Society (AWS) A5.10 for ER5356 aluminum alloy bare welding electrodes. Procedures, welders, and welding operators for welding on aluminum shall be qualified in accordance with the requirements ANSI/AWS D1.2-97 Structural Welding Code-Aluminum (1997).

1.11.8 The VMS housing shall be provided with two lifting eyes to be used when placing the housing on the sign structure. The lifting eyes shall be located such that the sign will remain level while being lifted. Each eye shall have a minimum diameter of 1.00 inch. The fully assembled sign shall be lifted into place using both lifting eyes. Each lifting eye, however, shall have sufficient structural strength to allow the sign to be lifted or moved without damage or permanent deformation to any part of the sign.

1.11.9 Screened weep holes shall be provided to allow the drainage of any water that may collect in the housing. The sign shall be fitted with weep holes that are properly screened and filtered to prevent the ingress of dirt and insects. Filtering characteristics shall be as noted herein. Weep holes shall be sufficient to ensure that there is no water accumulation within the sign case.

1.11.10 Lighting and Duplex Outlets:

1.11.10.1: The VMS unit does not have a walk-in cabinet. There is no light in the display housing. A light in the

display housing would not adequately light up all of the areas that might be of concern due to how thin the display is. There is a light provided in the control console.

1.11.11 Ventilation: The VMS system uses convection cooling, it does not have a filtered forced air system. PCS's experience with these VMS units has shown a 20 degree Fahrenheit delta between the temperature with venting and that without venting.

1.11.12 The front face panel is cleared by normal evaporative processes.

1.11.13 The VMS sign temperature cutoff is not necessary because the unit can operate safely and efficiently up to temperature not reachable in the environment. At temperatures above 105 degrees Celsius the performance of the unit is degraded but the unit should continue to operate.

1.11.14 Surface Treatment

The Contractor shall have the option of Surface Treatment and Painting described herein or Anodizing:

Alternative surface treatment and painting methods must equal or exceed those specified and be approved by the DEPARTMENT.

1.11.14.1: Anodizing

An anodic coating shall be applied to the aluminum surface after the surface has been cleaned and etched. The cleaning and etching procedure shall be to immerse in inhibited alkaline cleaner at 71° C for 5 minutes (Oakite 61A, Diversey 909 or equivalent in mix of 6 to 8 ounces per gallon to distilled water). Rinse in cold water. Etch in sodium solution at 66° C for 5 minutes (0.5 ounce sodium fluoride plus 5 ounces of sodium hydroxide mix per gallon to distilled water). Rinse in cold water. Desmut in a 50% by volume nitric acid solution at 20° C for 2 minutes. Rinse in cold water.

The anodic coating shall conform to MIL-A-8625C (Anodic coatings for Aluminum and Aluminum Alloys) for Architectural Class II A34 Coating with flat black dye required on the VMS front surface. The flack surface coating shall have a design life of a minimum of 10 years.

The anodic coating shall be sealed in a 5% aqueous solution of nickel acetate (pH 5.0 to 6.5) for 15 minutes at 99° C.

The black anodic coating shall be applied to the border on the entire front face of the VMS housing, screen assembly frames, the pixel matrix module panels (if applicable), and front access door (if applicable). All other surfaces shall be treated with clear anodic coating.

1.11.14.2: Surface Treatment for Painting

The VMS unit assemblies such as the pixel matrix module panels, front and access doors, etc., shall be treated prior to painting. The treatment steps are as follows:

1.11.14.2.1: Immediately prior to treatment, the aluminum surfaces shall be cleaned and prepared following the procedures in either ASTM D-1730, Type A, Method 3, or ASTM D-1730, Type B, Method 1 and/or meet or exceed the requirements of the paint manufacturer.

1.11.14.2.2: Surface treat aluminum in accordance with the provisions of ASTM D-1730, Type B, Method 6 or Method 7.

1.11.14.2.3: Any open seams which will retain moisture shall be caulked with a non-sag polyurethane material conforming to Federal Specifications TT-S-230 Type II or other approved material before the application of the finish coat.

1.11.15 Painting

1.11.15.1: General: The finish paint shall conform to the requirements for Automotive Grade Satin Black Acrylic Enamel. Black paint will dissipate heat.

1.11.15.2: Surface Preparation

The surface should be prepared according to the paint manufacturer's recommendations, using surface cleaners, sanding and body fillers (if required).

1.11.15.3: Vinyl Wash Primer: The surface shall be prepared using a vinyl wash, self-etching primer formulated specifically for application prior to painting clean aluminum, galvanized surfaces or surfaces previously coated with an organic or inorganic zinc-rich primer. This paint shall comply in all respects, with DOD-P-15328D, Primer (Wash) Pre-treatment (formula No. 117 for metals) or better. Vinyl wash primer should be formulated for spray application and shall be applied to a dry film thickness of 0.4 to 0.6 mils.

1.11.15.4: Primer: A double-coat of epoxy primer or surfacer shall be applied that is compatible with the final topcoat paint. This shall be applied to a dry film thickness of 2.0-2.5 mil thickness.

1.11.15.5: Topcoat Paint Application

After application of the vinyl wash primer and primer-surfacer, all exposed surfaces shall receive a minimum of 2 finish coats of an automotive grade acrylic enamel or urethane paint. The total dry film of the first finish coat shall not be less than 2 mils. The total dry film thickness of all applications of the second finish coat shall be not less than 2 mils or more than 4 mils. The 2 finish coats shall be applied in 2 or more applications to a total dry film thickness of not less than 4 mils or more than 8 miles.

The total dry film thickness of all paint applications shall be no less than 4.3 miles or more than 8.5 mils.

The minimum drying time shall meet the paint manufacturer requirements.

1.12 VMS Spare Parts Provisions

1.12.1 Manufacturer shall provide a priced spare parts list that includes all field replaceable modules and subassemblies as required to perform field repair and field preventative maintenance (e.g. controller for the sign, PCB's, filters, gaskets, special cleaning supplies, etc.). Provide spare parts list and pricing using Attachment D2. Prices shall include shipping of returned items sent to the manufacturer and replaced items sent to the DEPARTMENT. The manufacturer shall not require receipt of the returned item prior to shipping its replacement

1.12.2 Spare parts to be provided under this contract, when ordered by the DEPARTMENT, shall be supplied in separate cartons for each subassembly or assembly. Only complete assemblies or subassemblies shall be packed in each shipping carton.

1.12.3 The shipping carton and all packing materials shall be reusable such that the containers can be used to re-ship materials for repair. Each carton shall be suitable for shipping by common carrier without special handling.

1.12.4 All cartons shall be clearly marked on the outside with the part number, serial number, and the manufacturer's name and shipping address.

1.12.5 A return-shipping label shall be included with each spare, including vendor's desired mailing address and tracking number appropriate for the specific part being returned. The label shall also indicate the vendor's shipping account number where the shipping costs will be charged and the words "SHIPPING PAID BY RECIPIENT"

1.12.6 Spare parts shall be measured by the unit of each complete spare part, including packaging and shipping; and paid by the unit price for the spare part described in the manufacturer's spare parts price list, adjusted for inflation.

1.12.7 A spare LED display module is to be included with each sign and furnished as part of the contract unit price for the VMS.

1.13 Environmental Requirements

This Section sets forth the minimum environmental requirements for all the VMS equipment. All such equipment shall be singularly considered in meeting these specifications. Where applicable, the testing to verify compliance with these requirements shall conform to the current NEMA TS-1 environmental testing specifications, or as specified below.

1.13.1 Operating Voltage and Frequency

All equipment shall perform as specified under the following conditions:

1.13.1.1: Line Power

1.13.1.1.1: *Voltage:* The voltage range shall be from 97 to 135 Volts alternating current. The nominal voltage shall be 120 Volts alternating current.

1.13.1.1.2: *Frequency:* The operating frequency range shall be 60 Hertz, plus or minus three Hertz.

1.13.1.2: Solar Power with Battery Backup

1.13.1.3: *Voltage:* The voltage range shall be 11 to 15 Volts Direct current. The nominal voltage shall be 12 Volts direct current. The VMS system is based on stand alone solar powered system with battery storage. It is therefore designed to go into low voltage disconnect at 10.8 volts. The 10.8 volt level is based on saving the battery from destructively discharging. The system itself will operate below 10 volts with the first part of the system to not operate being the LCD interface. The integral embedded CPU will operate down to 5 volts. The LED's will also be visible below 10 volts.

1.13.2 Power Interruption

This Article is applicable for the VMS, the VMS controller and all communications equipment. The term "controller" shall be taken to mean the entire VMS field installation. Note that proper operation and startup shall be such that the controller memory, parameters, and firmware is not corrupted by any of the power interruptions identified below, further, improper messages shall not be displayed on the sign at any time. An electromechanical device shall be used to induce the power interruptions.

1.13.2.1: The power interruption shall define the controller mode of operation upon restoration of power relative to

the length of time the power has been interrupted.

1.13.2.2: Two or more power interruptions separated by power restoration of 1,500 milliseconds or greater shall be considered as separate interruptions, and the controller shall react to the power interruptions as follows:

1.13.2.3: Interruption of 500 milliseconds or less: Upon restoring power, the controller shall continue to operate as though the power interruption had not occurred.

1.13.2.4: Interruption of more than 500 milliseconds: Upon restoring power, the controller shall either continue to operate as specified above or shall revert to its start-up sequence.

1.13.2.5: Continuous linear power reduction and increase, from 120 Volts (RMS) to 0 Volts (RMS) to 120 Volts (RMS) at a rate of voltage change no greater than 1 volt per second: The VMS, VMS controller and communications equipment shall revert to the start-up sequence within 500 milliseconds of reaching 95 Volts (RMS) during power increase.

1.13.3 Temperature and Humidity

General: Equipment shall operate as specified when the temperature and humidity ambient inside the controller cabinet are within the following specified limits:

1.13.3.1: Ambient Temperature

1.13.3.1.1: The operating ambient temperature range shall be from minus 30°F to plus 165°F.

1.13.3.1.2: The storage temperature range shall be from minus 50°F to plus 200°F.

1.13.3.1.3: The rate of change in ambient temperature shall not exceed 30°F per hour, during which the relative humidity shall not exceed 95 percent.

1.13.3.2: Humidity: The relative humidity shall not exceed 95 percent over the temperature range of 40°F (4.4°C). Above 100°F (43.3°C), constant absolute humidity shall be maintained, which results in the relative humidity's shown in the table below. The relative humidity's shown in the table below are for dynamic testing:

At 29.92 HG Barometric Pressure		
Dry Bulb (°F)	**Relative Humidity (percer**	**Wet Bulb (°F)**
40	75	37
50	80	47
60	83	57
70	86	67
80	87	77
90	89	87
100	89	97
110	90	107
120	70	109
130	50	109
140	38	109
150	28	109
160	21	109
165	18	109

1.13.4 Vibration

The equipment shall operate as specified and maintain its physical integrity when subjected to a vibration of five to 30 cycles per second up to 0.5 gravity applied in each of three mutually perpendicular planes.

1.13.5 Shock

The equipment shall suffer neither permanent mechanical deformation nor any change that renders the unit inoperable, when subjected to a shock of 10 gravities applied in each of three mutually perpendicular planes.

1.13.6 Transients

1.13.6.1: Power Service: The equipment shall operate in accordance with its specified function when the following independent test pulses occur on the alternating current power service.

1.13.6.2: High-Repetition Noise Transients: The test pulses shall not exceed the following conditions:

1.13.6.2.1: Amplitude - 300 Volts, both positive and negative polarity.

1.13.6.2.2: Peak Power - 2,500 Watts.

1.13.6.2.3: Repetition - 1 pulse approximately every other cycle moving uniformly over the full wave in order to sweep 360 degrees of the line cycle once every 3 seconds.

1.13.6.2.4: Pulse Width - 10 microseconds.

1.13.6.3: Low-Repetition High Energy Transients: The test pulses shall not exceed the following conditions:

1.13.6.3.1: Amplitude - 600 Volts, plus or minus 5 percent, both positive and negative polarity.

1.13.6.3.2: Energy Source - Capacitor, oil filled, 10 microfarads plus or minus 10 percent, internal surge impedance less than 1 ohm.

1.13.6.3.3: Repetition - 1 discharge every 10 seconds.

1.13.6.3.4: Pulse Position - Random across 360 degrees of the line cycle.

1.13.6.4: Input-Output Terminals: The equipment shall operate in accordance with specification requirements when the following test pulse occurs on the input-output terminals for any signal that leaves the VMS sign enclosure or VMS control cabinet.

1.13.6.4.1: Amplitude - 300 Volts, both positive and negative polarity.

1.13.6.4.2: Pulse Source - 1,000 ohms nominal impedance.

1.13.6.4.3: Repetition - 1 pulse per second, for a minimum of 5 pulse per selected terminal.

1.13.6.4.4: Pulse Rise Time - 1 microsecond.

1.13.6.4.5: Pulse Width - 10 microseconds.

1.13.6.5: Non-Destructive Transient Immunity: The equipment shall be capable of withstanding a high-energy transient having the following characteristics repeatedly applied to the alternating current input terminals (no other power connected to terminals) without failure of the test specimen:

1.13.6.6: Amplitude - 1,000 Volts, ± 5 percent, both positive and negative polarity.

1.13.6.7: Energy Source - Capacitor, oil filled, 15 microfarads, ±10 percent, internal surge impedance less than 1 ohm,

1.13.6.8: Repetition - Applied to the controller assembly once every two seconds for a maximum of three applications each polarity.

1.13.6.8.1: After the foregoing, the equipment shall perform all of its functions upon application of nominal alternating current power. Note that none of these transients shall cause the internal timing of the VMS to drift and all memory and displays shall not be corrupted.

1.14 RADAR UNIT

1.14.1 General:

1.14.1.1: The radar unit shall be integrated with the VMS housing. The unit shall function as an accessory unit to the VMS, connected to the same power supply.

1.14.1.2: The DCWS shall come equipped with a radar unit consisting of:

1.14.1.2.1: An externally mounted transceiver (gun), mounted beneath the sign structure of the VMS case with a mounting that permits a minimum 30 degrees horizontal adjustment;

1.14.1.2.2: An internally mounted signal processing board;

1.14.1.2.3: Software to make the unit programmable;

1.14.1.2.4: Calibration Equipment.

1.14.1.2.5: RS232C communications cable connecting the radar unit to the VMS controller

1.14.2 The radar unit shall be listed on the most recently published Consumer Product List (CPL) of Police Traffic Radar Speed Measuring Devices published by the International Association of Chiefs of Police (www.theiacp.org) or approved equivalent.

1.14.3 The radar unit shall have the following capabilities:

1.14.3.1: Band: K required, Ka and X optional

1.14.3.2: Stationary

1.14.3.3: Non-handheld

1.14.3.4: Fastest Target

1.14.3.5: Discriminate Direction

1.14.3.6: Frequency shall be within range permitted by the Utah Highway Patrol and the FCC. The frequency variance shall not exceed plus or minus 50 MHz.

1.14.3.7: Output power: 10mW minimum, 20mW maximum

1.14.3.8: Output power density: less than $5mW/cm^2$

1.14.3.9: RS-232 communications output (for integration with the VMS controller)

1.14.4 Radar unit shall output current detected speed to the VMS controller at a rate of 10 times per second.

1.14.5 Radar unit shall output speed in the format defined by the NTCIP "dmscurrentspeed" MIB object of the VMS objects group.

1.14.6 Environmental

1.14.6.1: Supply voltage: 10.8VDC – 24VDC

1.14.6.2: Maximum operating current: 250ma @ 12V, 125ma @ 24V

1.14.6.3: Surge current requirement: 1 amp

1.14.6.4: Operating temperature: -22°F to +158°F (-30°C to + 70°C)

1.14.6.5: Maximum humidity: 100% (weatherproof, not waterproof)

1.14.6.6: Polarization: Linear

1.14.7 Physical Dimensions

1.14.7.1: Weight: 2 pounds, maximum

1.14.7.2: Length: 8 inches maximum

1.14.7.3: Width: 4 inches maximum

1.14.8 Range & Accuracy:

1.14.8.1: Beam width, minimum: 12 degrees vertical, 12 degrees horizontal

1.14.8.2: Detection range: 1,500 feet minimum

1.14.8.3: Speed range: 10 – 150 mph (or better), programmable to more limited range

1.14.8.4: Speed accuracy: plus or minus 0.5mph

1.14.8.5: Target acquisition time: 0.10 milliseconds, maximum

1.14.8.6: Selectable output rate when target speed changes: 1-10 times per second, minimum

1.14.8.7: Data hold time when polled: 1 – 10 seconds, minimum

1.14.9 Spare parts, warranty: See project specific Special Provisions

1.15 Standards Compliance

If the DEPARTMENT or the VMS manufacturer discovers an ambiguous statement in the standards referenced by this procurement specification, the proper interpretation shall be decided by the relevant NTCIP working group (where applicable). The following is a list of standards and specifications that must be in full compliancy:

1.15.1 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, latest revision

1.15.1.1: ANSI/AWS (American Welding Society) D1.2 – Structural Welding Code – Aluminum

1.15.1.2: NCHRP Report 412, Fatigue-Resistant Design of Cantilevered Signal, Sign, and Light Supports

1.15.1.3: National Electric Code (United States)

1.15.1.4: NEMA Standards Publication 250 – Enclosures for Electrical Equipment

1.15.1.5: NEMA Standard TS-1, Section 2 – Environmental Standards and Test Procedures, Traffic Control Systems

1.15.1.6: NTCIP Standards:

1.15.1.6.1: NTCIP 1101: NTCIP 1101:1997 (NEMA TS 3.2-1996); *Simple Transportation Management Framework*

1.15.1.6.2: NTCIP 1102: NTCIP 1201 v01.06, *Octet Encoding Rules (OER) Base* Protocol

1.15.1.6.3: NTCIP 1103: Not Applicable

1.15.1.6.4: NTCIP 1201: NTCIP 1201:1996 (NEMA TS 3.4-1996); Global Object *Definitions*

1.15.1.6.5: NTCIP 1203: NTCIP 1203:1997 version 1.15, Amendment 1 (July 2001); *Object Definitions for Dynamic Message Signs*

1.15.1.6.6: NTCIP 2001: NTCIP 2001:1996 (NEMA TS 3.3-1996); *NTCIP Class B Profile*

1.15.1.6.7: NTCIP 2101: NTCIP 2101 v01.17 (NEMA TS3.SP-PMPP232), *Point to Multi-Point Protocol Using RS-232 Subnetwork Profile*

1.15.1.6.8: NTCIP 2102: NTCIP 2102 v01.04, *Subnet Profile for PMPP Over FSK Modems*

1.15.1.6.9: NTCIP 2103: NTCIP 2103 v01.05 (NEMA TS 3.SP-PPP232), *Subnet Profile for Point-to-Point Protocol Over RS-232*

1.15.1.6.10: NTCIP 2104: NTCIP 2104 v01.07, *Subnet Profile for Ethernet*

1.15.1.6.11: NTCIP 2201: NTCIP 2201 v01.11, *Transportation Transport Profile*

1.15.1.6.12: NTCIP 2202: NTCIP 2202-1999, *Internet (TCP/IP and UDP/IP) Transport Profile*

1.15.1.6.13: NTCIP 2301: NTCIP 2301-1999 (NEMA 3.AP-STMF), *Application Profile for Simple Transportation Management Framework (STMF)*

1.16 DCWLSS Shipping Requirements.

1.16.1 General: All internal and external components should be securely fastened to prevent any component from dislodging during transport. The sign and all other purchased components will be inspected upon receipt to visually ascertain any damage and items that may have been dislodged. The manufacture shall provide the transport company with appropriate instructions to insure safe transport.

1.17 Method of Measurement Dynamic Curve Warning LED Sign System

The Dynamic Curve Warning LED Sign System shall be measured for payment by complete system each, complete with all components and requirements provided as noted in this specification, and delivered as directed by the Ordering Agency or STATE Purchasing Agent.

1.18 Basis of Payment for Dynamic Curve Warning LED Sign System

The Dynamic Curve Warning LED Sign System will be paid for at the contract unit price each as measured above, which shall be payment in full for a complete functional sign system, including the following:

- LED Sign System
- Radar Unit,
- One (1) spare LED display module,
- 5-year warranty,
- Shipping / transportation
- and incidentals necessary to complete this item of work.
- Acceptance of the VMS for payment shall follow the requirements of the Acceptance Procedures as outlined Attachment B, Article 7.0.

1.19 Training

1.19.1 Description: Work under this item shall consist of providing qualified instructors and all materials for training Department personnel and other designated personnel in the operation and maintenance of the various equipment and components Variable Message Signs furnished under this contract

1.19.2 The contractor shall develop and submit training course outline and samples of all training aids and manuals to the engineer for approval 30-days prior to delivery of first sign. Written approval of this material shall be required prior to the final scheduling of the training sessions or the final production of the training materials.

1.19.3 The training sessions described under this item shall include training on the use of the any test equipment that the contractor recommends.

1.19.4 All training sessions shall be conducted at locations within Salt Lake County, Utah or as designated by the Department. Training sessions shall not overlap unless otherwise permitted by the Department.

1.19.5 Training shall consist of formal classroom lectures as well as "Hands – On" training. "Hands – On" training shall consist of working with the actual equipment.

1.19.6 A training session shall consist of a total of 4 hours, with 2 hours minimum of classroom time and up to 2 hours of

"hands-On training. The attendance of a session shall have no greater than 10 people to maximize individual interaction. Each session shall provide a basic understanding of the equipment and subsystems and their operation and maintenance. These training sessions shall include as appropriate, and as a minimum:

1.19.6.1: Background on concepts of equipment / subsystems and theory of operation;

1.19.6.2: Functional description of subsystem VMS components, including, but not limited to, radar assemblies, solar power, and classification devices;

1.19.6.3: Procedures for installing and setting up equipment and components;

1.19.6.4: Basic trouble-shooting and fault determination procedures, including use of test equipment;

1.19.6.5: Preventive maintenance procedures and schedules

1.19.7 Method of Measurement: Training shall be measured for payment by day for a complete training session, with all requirements and materials described in this specification.

1.19.8 Basis of Payment: Training will be paid for at the contract unit price each as measured above, which shall be payment in full for a training session.

1.20 Solar Power System

1.20.1 Description - In most cases, the Dyamic Curve Warning LED Sign System will be powered using commercial AC electrical service. In some cases, power will not be available and the sign system will be required to operate using solar power. The solar sites will often be situated along windy roads and narrow canyons, with limited exposure to sunlight. The solar equipment should be designed with the following parameters:

1.20.1.1: Average Annual Daily Traffic: 7,000 Vehicles

1.20.1.2: Directional split: Assume 50% (or 3500 vehicles approaching sign)

1.20.1.3: Percent Trucks: 26%

1.20.1.4: Percent of all vehicle exceeding 10 mph over advised speed: 70%

1.20.1.5: Approx. sign on-time: 5 seconds (2.5 secs per frame, 2 frame message)

1.20.1.6: Location: US 6 near Spanish Fork, Utah, Milepost 180.5.

- Latitude: -111.377477
- Longitude: 39.989096

1.20.1.7: Battery Power Reservoir (Without solar energy charge): 5 Days

1.20.1.8: Battery shall be a deep cycled, sealed, gel filled or approved equivalent.

1.20.1.9: Solar Cabinet compartments shall be designed for safety and ease of maintenance.

1.20.1.10: Solar Cabinet Access door(s) shall have stainless steel piano hinges. All fastening hardware shall be rustproof.

1.20.1.11: There shall be provision for utility seals on access panels and doors.

1.20.1.12: The battery compartment shall be designed to reduce damage from possible battery failures.

1.20.1.13: Batteries shall remain in their designated position during an earthquake when the cabinet doors are closed.

1.20.1.14: The Batteries shall be manufactured in the United States of America using standard BCI case sizes.

1.20.1.15: The Batteries shall be a standard catalog item, available from two or more manufacturers.

1.20.1.16: Batteries shall be secured on to a separate pallet and properly labeled for shipment

1.20.2 Method of Measurement: The solar power system shall be measured for payment by complete solar systems each, complete with all components and requirements provided as specified in this specification, and delivered as directed by the Ordering Agency or STATE Purchasing Agent.

1.20.3 Basis of Payment: The Solar Power System will be paid for at the contract unit price each as measured above, which shall be payment in full for a complete solar system, which should include solar panels, top of pole mounts, Charge Regulator, Sealed Batteries insulated battery enclosure, solar and battery wire kit, shipping/transportation and incidentals necessary to complete this item of work.

1.21 Engineering Services

1.21.1 The Vendor shall provide the services of a qualified engineer/technician on site for the purpose of assisting DEPARTMENT in troubleshooting problems with the sign or the integrated system. Such services may include but not be limited to system troubleshooting, communications troubleshooting, system integration support, and sign troubleshooting. The contractor shall submit the name and qualifications of the person that will be providing such services for review and approval prior to the start of any such work. The rate quoted for this service is measured in calendar days and for all costs including but not limited to living expenses, local transportation, airfares, travel time, labor, telephone, and all other incidental expenses. For the basis of estimating these costs, DEPARTMENT will contract for a minimum of 3 days at a time. The time paid shall be for a minimum of 8 hours per day actively assisting the DEPARTMENT..

1.21.2 It is recognized that it is often difficult to determine the exact cause of a problem, and hence this line item is available for DEPARTMENT to contract for engineering services to assist in resolving different types of problems. However, if the cause of the problem is the direct result of a design defect in the sign, its internal software, and/or documentation, all costs including labor shall be the responsibility of the vendor/contractor and DEPARTMENT will not reimburse the contractor for either the time or expenses. DEPARTMENT shall determine if such charges are the result of vendor/contractor defects and shall submit written resolution immediately following the conclusion of the engagement.

1.21.3 DEPARTMENT shall provide the contractor of the need for such services and the vendor/contractor shall be available to report to DEPARTMENT at 8:00 AM on-site within 72 hours of such notification. Failure to report to the job site within the 72 hours allowed or such other time as determined by DEPARTMENT (but not less than 72 hours) shall result in the assessment of late fees in the amount of $1000 per day until such time as the approved engineer/technician is available on-site.

1.21.4 Payment will be made on the basis of calendar days spent on-site for each engagement. Such engagements may be extended on a day-by-day basis at the option of DEPARTMENT until the problem is resolved.

1.21.5 Method of Measurement

1.21.5.1: Engineering field services will be measured as days, which shall be the number of days as defined herein.

1.21.6 Basis of Payment –

1.21.6.1: Engineering field services, measured as provided above, will be paid for at the contract unit price per day, which price shall be full compensation for furnishing field personnel to provide engineering services; and for all labor, equipment, transportation, and incidentals necessary to complete this item of work.

ATTACHMENT C

SPECIAL TERMS AND CONDITIONS

1. Invoicing: CONTRACTOR shall submit invoices to the Ordering Agency and as directed by the State Purchaser. As a minimum, the invoice shall include the name of the Vendor, the State of Utah Contract Number, the Ordering Agency Purchase Order or PG number, the invoice date, and the remittance address. Each product purchased shall be itemized, showing the number of purchased units by model, the unit costs, serial numbers (if applicable), and the total amount of each item. Invoices that do not meet these requirements shall not be considered responsive.

The State shall be invoiced as follows for each sign purchase:

1.1 1st Invoice - 75% of Purchase Price after unit has successfully passed the Receiving Site Acceptance Test as described elsewhere in these Special Terms and Conditions.

1.2 Final Invoice - 25% of Purchase Price after the unit has successfully completed the 30-Day Continuous Test and as directed under Article 2 – Final Payment. The invoice should indicate that it is a "Final Invoice" (for each purchase). The Ordering Agency shall process invoices for payment within thirty (30) days after receipt and send via postal mail. However, the STATE, at its sole discretion and after giving the Vendor written notification, may delay payment of invoices that are disputed or that are submitted without the specified forms, reports and deliverables.

2. Final Payment: Final payment will be issued after Final Acceptance has been made as described in, Article 7 and required data submittals as described in Article 8 have been received and accepted by the STATE Project Manager as accurate and complete.

3. Price Guarantees: All pricing must be guaranteed for the entire term of the contract. The State will be given the immediate benefit of any price reductions, or allowable discount on any of the contract items.

4. Notification: Notice given under this Contract shall be written, or sent by facsimile or other electronic means. Written notice shall be sent by registered or certified mail, postage prepaid, return receipt requested, or by any other overnight delivery service which delivers to the noticed destination and provides proof of delivery to the sender. Facsimile or other electronic notice must be followed within three (3) days by written notice.

5. Responsibility for Wages: The Contractor shall be responsible for all applicable company wages in accordance with the Federal, State and local laws and ordinances.

6. General Warranty Provisions: A manufacturer's guaranty shall be provided for five (5) years on all equipment and materials furnished as part of the pay items for all VMS equipment and materials and as described under this section.

6.1 General

The warranty period begins at *final acceptance*. The five-year warranty period consists of a one year full-warranty and an additional four-year warranty on equipment.

6.1.1 **One year full warranty on parts and labor**

The terms of the VMS equipment and materials guaranties shall stipulate that the VMS manufacturer is fully responsible for all parts, labor, diagnosis, removal, shipping, handling, and reinstallation for the repair or replacement of any malfunctioning, failed, problematic, or otherwise unacceptable VMS equipment. The terms of the VMS equipment and materials guaranties and full warranty shall be in effect for one calendar year after final acceptance.

6.1.2 **Four year warranty on all equipment**

The terms of the VMS equipment and materials guaranties shall stipulate that the VMS manufacturer is fully responsible for all parts, diagnosis, shipping, and handling, for the replacement of any malfunctioning, failed, problematic, or otherwise unacceptable VMS equipment. The STATE will provide labor to remove and reinstall the equipment at no cost to the Contractor. The terms of the VMS equipment and materials guaranties and equipment warranty shall be in effect four calendar years after the full warranty period has ended.

6.1.3 Any component or electronic or electrical assembly or sub-assembly which experiences more than three failures during the five-year warranty period shall be replaced with a new component, assembly or sub-assembly.
6.1.4 All electronic and electrical assemblies and subassemblies shall be permanently marked with the manufacturer's name, model number, date of manufacture, and a unique serial number. The model number (and revision if applicable) shall be consistent with the VMS documentation for assembly drawings, schematics, bills of materials, and maintenance manuals.

6.2 Telephone Support

The vendor/contractor shall provide telephone assistance of a qualified engineer/technician for the purpose of assisting the STATE in troubleshooting problems with the sign or the integrated system as they interoperate with the delivered signs. Such assistance shall be available between the hours of 8:00 AM and 5:00 PM Mountain Standard Time and shall be provided at no cost for a period of 5 years from final acceptance.

6.3 Licensing

Under the terms of this contract, the VMS manufacturer is required to supply complete documentation for all software and firmware provided as part of the VMS system. The VMS supplier shall ensure that all licensed software provided as part of the VMS system shall be transferred to the STATE.

6.3.1 The manufacturer shall provide free software upgrades for a period of one year from final acceptance. Upgrades are mandatory for bug fixes and any NTCIP updates that are adopted by the STATE.

6.3.2 The software documentation shall include 3.5" floppy disk(s) and a CD-ROM containing ASCII versions of the following Management Information Base (MIB) files in Abstract Syntax Notation 1 (ASN.1) format:

6.3.2.1 The relevant version of each official standard MIB Module referenced by the device functionality.

6.3.2.2 The manufacturer shall avoid the use of proprietary MIB objects. Standard MIB objects shall be used whenever possible. The manufacturer shall formally justify any proprietary MIB extension. The STATE reserves the right to require the use of an appropriate standard MIB extension, if available, to replace the manufacturer's proposed proprietary extension. In the event STATE approves a manufacturer specific version of the official Standard MIB Module, the manufacturer shall provide an OBJECT TYPE macro that supports the full range of the equivalent standard MIB. The macro shall be written in ASN.1 format in the SYNTAX and/or DESCRIPTION fields of the associated OBJECT TYPE. The file name of this file shall be identical to the standard MIB Module, except that it will have the extension ".man". Regardless of whether the MIB uses proprietary objects or not, STATE shall have the unrestricted right to make public (in both written and electronic form) the full and complete MIB for the VMS for all future procurements. Further, the sign vendor shall have no claim against STATE or any vendor that uses the same MIB for future VMS installed within STATE's jurisdiction and/or any projects and systems connected thereto.

6.3.2.3 A MIB Module in ASN.1 format containing any and all manufacturer-specific objects supported by the device with accurate and meaningful DESCRIPTION fields and supported ranges indicated in the SYNTAX field of the OBJECT-TYPE macros.

6.3.2.4 A MIB containing any other objects supported by the device.

7. Acceptance Procedures: The STATE will, at its discretion, conduct acceptance procedures for any VMS provided under the contract, as follows:

- ☐ Formal Factory Acceptance Test Upon conclusion of sign production at the factory;
- ☐ Receiving Site Acceptance Test Upon delivery to the Traffic Operation Center (Salt Lake City), the construction contractor, or job site; and
- ☐ 30-Day Continuous Operation Test prior to final acceptance

7.1 Scope

This section sets forth acceptance procedures for the supply of Variable Message Signs. All costs associated with acceptance testing and procedures shall be paid for, as a part of the CONTRACT pay items and the STATE shall make no separate payment for acceptance testing and procedures.

7.2 General Requirements

Unless otherwise stipulated, the CONTRACTOR shall develop, provide all equipment for, and perform all acceptance testing for all Variable Message Signs supplied. The test plan shall be a step-by-step procedure identifying the configuration to be tested, how the device is wired, the placement of all measurement and test equipment, and the expected results of all tests. Testing shall include both positive and negative testing to ensure that the VMS performs properly given both good and bad data on the communications facility. All test plans shall be submitted at least 30 days prior to the anticipated test date. Approval of the engineer is required before scheduling the tests to occur. During all testing, the vendor shall be responsible for recording all results and publishing a complete test report identifying the tests performed and the results of each test.

7.2.1 The CONTRACTOR shall provide all necessary testing equipment, facilities, communications, and transportation between test sites. The CONTRACTOR shall have a complete copy of all material and equipment submissions and all documentary items on hand at all acceptance testing sessions. This shall include but not be limited to manufacturer's data sheets for all components, certifications where applicable, mechanical and electrical drawings, schematics, assembly drawings, construction notes, software listings, operations and maintenance manuals.

7.2.2 Upon receipt of the CONTRACTOR's test report for a given VMS, the STATE shall provide a written acceptance or rejection of that test within ten (10) calendar days. If the outcome and/or results of a given test are rejected, the CONTRACTOR shall be notified of the specific reasons for non-acceptance. The CONTRACTOR shall make all necessary corrections and revisions to the subject materials and/or equipment and any accompanying documentary items. Once the contractor has completed all necessary corrections and revisions, the CONTRACTOR shall request a retest in writing. The CONTRACTOR's request for a retest shall include complete written summary of all corrections and revisions performed and, if applicable, revised documentary items. No retesting shall commence without the STATE's prior approval. All retests shall be conducted in accordance with the requirements of the initial test. Contact Joe McBride at 887-3716 within 7 calendar days prior to testing.

7.2.3 Specific equipment or materials that have been rejected as part of any submission review or testing may be offered for consideration again by the CONTRACTOR, provided all noncompliance has been corrected and pre-tested by the CONTRACTOR, and provided that the CONTRACTOR has requested in writing that this specific equipment or materials be reconsidered.

7.2.4 At the conclusion of a given acceptance test for a given VMS, the CONTRACTOR shall provide a thorough and detailed test report in accordance with the test plan which documents the outcome of all tests and provides complete test result data. The CONTRACTOR shall deliver two (2) copies of this report to the STATE within ten (10) calendar days after the conclusion of that test.

7.3 *Factory Acceptance Testing:* The CONTRACTOR shall perform Factory Acceptance Testing on the first of each VMS model ordered. A new factory acceptance test for a previously ordered model may be waived by the STATE for additional orders of the same model within 12 months of the original factory acceptance test. The purpose of the factory acceptance test is to verify that the sign fully conforms to the requirements of these specifications including design, materials, quality, documentation, and "maintainability".

7.3.1 The CONTRACTOR shall provide a complete Factory Acceptance Test Plan. The Factory Acceptance Test Plan shall be a detailed and thorough procedure that fully demonstrates that the complete VMS meets all CONTRACT requirements. These requirements shall include, but not be limited to, all design, construction, materials, equipment, assembly, environmental, performance, communications, failure recovery, diagnostic, central control system communications (including validation using a data analyzer), dimming control, light emission, ambient light sensing, VMS display alignment, NTCIP compliance and documentary requirements. The CONTRACTOR shall define the failure measurement criteria for each test. The CONTRACTOR shall set up test plans that include testing the performance when parameters are out of range. The Factory Acceptance Test procedure shall contain a method by which the actions and status of a given VMS as reported by the central control system can be positively verified by actual field observation.

7.3.2 Factory Acceptance Testing shall commence only after all of the documentary items have been approved by the STATE.

7.3.3 The CONTRACTOR shall perform a Factory Acceptance test for one or more signs, with notice in writing a minimum of 30 calendar days in advance of that test session. The CONTRACTOR shall permit the STATE to adjust the proposed schedule of the Factory Acceptance Test by up to seven (7) calendar days at no cost to the STATE. Any given Factory Acceptance Testing session shall be completed within five (5) consecutive (contiguous) working days unless otherwise approved by the STATE.

7.3.3.1 If, during the scheduled factory acceptance testing, the VMS fails to meet the specification requirements (e.g. fails to perform properly), The VMS supplier shall correct the problem and reschedule the testing as required above. If a re-test is required, then the VMS supplier shall be responsible for all costs associated with the re-test, which shall include any consultant costs, travel, and per diem costs for all observers. Such amounts shall be paid for as Factory Acceptance Travel Costs.

7.3.3.2 The procedures listed below shall be followed in repair of equipment before shipment.

7.3.3.2.1 Any defects or deficiencies found by the inspection system involving mechanical structure or wiring shall be returned through the manufacturing process or special repair process for correction.

7.3.3.2.2 PCB's shall be repaired as necessary providing such repairs do not compromise the future reparability of the subassemblies or the reliability of the unit.

7.4 *Receiving Site Acceptance Test* (RSA) (Payment 75% when RSA Test completed) The CONTRACTOR shall provide a complete RSA Test Plan submission for approval by the STATE. The RSA Testing will be used by the STATE to verify compliance with the Specifications, and as a minimum, shall consist of the following functional tests:

7.4.1 Demonstrate 100% compliance with NTCIP protocol stack operating within an automated poll-response environment;

7.4.2 Demonstrate features of the VMS controller and sign display assembly via direct connect and modem communications;

7.4.3 Demonstrate fault-free operations of the VMS assembly under test when subject to 500 cycles of status request command and response operations between the VMS and the test software;

7.4.4 Demonstrate fault-free operation of the VMS assembly under test when subjected to 1000 cycles of message download command, message download response, message display command, message display response, CMS status command, and VMS status response. Perform one complete cycle in 20 seconds or

less with a VMS message constructed such that a character message fills every available character space on a two-phase message. Set the phase time on to three seconds for each phase and the off time to zero seconds;

7.4.5 Demonstrate that the VMS always recovers properly following disruption on the communications line and power interruptions occurring at any time during the communications processes. The test software shall be used to verify that memory contents are not corrupted during power outages and that communications faults do not cause the sign to reset, halt, or otherwise require field intervention for recovery;

7.4.6 Record all communications between the test software and the VMS under test using a protocol analyzer. Record serial data captured by the protocol analyzer on media printable from the protocol analyzer to an ANSII character printer. Provide test results to STATE as part of the RSA test results; The CONTRACTOR shall request a RSA Test in writing a minimum of 15 calendar days in advance of that test session. The CONTRACTOR shall permit the STATE to adjust the proposed schedule of the RSA Test by up to seven (7) calendar days at no cost to the STATE to allow for availability of STATE representatives. The RSA Testing session shall be completed by the STATE within five (5) consecutive working days after the RSA Test is initiated.

7.4.7 Demonstrate the integrated radar unit is functioning properly and is sending the correct communication to the VMS Controller using the protocol analyzer.

7.5 30-day Continuous test for Variable Message Sign Installations

7.5.1 General Requirements: A 30-day continuous test will be required for all work and equipment included in the CONTRACT. The continuous test shall consist of the field installed operation of the VMS system in a manner that is in full accordance with the VMS system requirements described above. An acceptance test procedure is not required for the system burn-in.

7.5.2 The continuous test shall commence only after all of the following requirements have been met:

7.5.2.1 All work required in all CONTRACT DOCUMENTS (except this continuous test) is completed;

7.5.2.2 All RSA tests are successfully completed;

7.5.2.3 VMS has been installed and made operational in the field (this work to be performed by others within 30 days of RSA Test). (Final Payment of 25% after 30-Day continuous test).

7.5.3 The STATE will commence this continuous test after final installation of the VMS is complete, and will terminate 30 consecutive days thereafter unless an equipment malfunction occurs. The continuous test will be stopped for the length of time any equipment is defective.

7.5.4 Notification shall be deemed to have occurred whenever STATE personnel provide a verbal notification to the CONTRACTOR. Note further that if the failure is due to a design defect (hardware or software) of the sign, the test shall be restarted only after the defect has been corrected. All signs ordered by the STATE and received concurrently or within 30 days of the subject sign shall be updated with the correction, and the testing of these signs shall be restarted.

7.5.5 Successful completion and acceptance of the continuous test will be granted on the 30^{th} day unless:

7.5.5.1 Any equipment is malfunctioning on the 30th day, in which event final acceptance will be withheld until repair is completed and all equipment is functioning properly for 30 days after repair.

7.5.5.2 Any equipment has malfunctioned during the 1st through 29th day of the continuous test, in which event final acceptance will be withheld until all the equipment is functioning properly for 30 days after repair.

7.5.6 When a specific piece of equipment has malfunctioned more than three times during the 30-day continuous test, the CONTRACTOR shall replace that equipment with a new unit and the continuous test shall restart for that sign.

7.5.7 The STATE shall maintain records of equipment malfunctions. The CONTRACTOR shall furnish written reports to the STATE noting all failures reported, the date and time of the report, the affected systems or subsystems, and a detailed report of all components used to repair the problem. Repairs shall be documented in a manner which notes the exact procedures used to determine the cause of the problem, all components used for repair, and all testing performed to verify that all necessary repairs have restored the equipment to full operation.

7.5.8 The STATE shall review the operation and maintenance history of the signs during the continuous test. If analysis of the failures indicates that there is a design defect in the VMS, then the 30-day continuous test shall be halted until such time as the CONTRACTOR corrects the problem for all VMS. The 30-day

continuous test shall then be restarted from the beginning. During any suspension, the contractor shall be responsible for continuing operation and maintenance of the VMS as noted below, even though the continuous test has been suspended. Use of the VMS by the STATE during this period shall not be construed as acceptance of the VMS. When a restart of the 30- day continuous test has been mandated for the third time for a particular VMS based on the failure of components on that VMS, the VMS shall be removed and replaced with an entirely new unit at the Contractor's expense.

7.5.9 During the continuous test, the CONTRACTOR shall be responsible for the maintenance of all work under this CONTRACT. Failure to restore any work or equipment to proper operating condition within seventy-two (72) hours after notification shall constitute default by the CONTRACTOR.

7.5.10 STATE responsibilities during the continuous test shall be as follows:

7.5.10.1 Arrangements for VMS field installation within 30 days of RSA and in accordance with the sign manufacturer's specifications. If the STATE does not complete field installation within 30 days of RSA, the 30-day continuous test shall be reduced by one day for each day of delayed field installation. If the STATE does not complete field installation within 60 days of RSA, the continuous test requirement shall be waived and the sign shall be deemed to receive final acceptance by the STATE;

7.5.10.2 Expeditious notification of CONTRACTOR upon failure or malfunction of equipment;

7.5.10.3 Repair or replacement of any part of the installation damaged as a result of natural causes and those resulting from events outside control of the CONTRACTOR.

7.6 Final Acceptance
Final acceptance of the VMS will be made after satisfactory completion of the required continuous test, and correction of all deficiencies, manufacturer's tests and certifications. For any materials or equipment which may not require formal testing, the STATE reserves the right to require certifications from the manufacturer of such equipment and material, to the effect that they meet all requirements of the CONTRACT, and, in the event of questionable equipment or material, to require that such material or equipment be tested by a recognized laboratory or other entity of its choice at no expense to the STATE. The STATE reserves the right to withhold any payments that may be due, should it be discovered that the equipment does not meet the requirements of the CONTRACT.

8. Submittal Data Requirements: The following section applies to the 1st model of each sign of each type ordered by the Ordering Agency and/ or as required by the STATE.

8.1 The following submittals and documentary items are required:

8.1.1. Design, materials, and construction of the VMS display and housing;

8.1.2. Design, materials, and construction of the VMS controller;

8.1.3. Design, materials, and construction of the VMS housing door and platform;

8.1.4. Materials and attachment method of the horizontal and vertical conduit;

8.1.5. Design, materials, and installation requirements for all connections between the sign elements and with the communications network and power;

8.1.6. Quality Assurance, test, and inspection procedures employed during manufacture;

8.1.7. List of custom or sole source components;

8.1.8. Factory Acceptance Test Procedure;

8.1.9. Draft Receiving Site Acceptance Test Procedure;

8.1.10. Draft 30-Day Continuous Test Procedure;

8.2 Submittal data and shop drawings for all equipment and materials required in this CONTRACT shall be submitted within 30 calendar prior to any installation, unless otherwise noted in the specifications.

8.3 Shop drawings are required for all structural support materials, VMS housing materials, and all other special designs, non-electrical, non-mechanical, fabricated items which are not certified.

8.4 The STATE will not be liable for any equipment or material purchased, work done, or delay incurred, prior to the STATE's approval of said equipment or material.

8.5 Six copies of all submittal and documentary data shall be provided to the STATE. Any failure of the STATE to discover or note any unsatisfactory material shall not relieve the CONTRACTOR of his responsibility for providing complete and operable ATMS equipment as called for under the terms of the CONTRACT.

ATTACHMENT D

Dynamic Curve Warning LED Sign System Pricing

Item	Description	Model/ Product No.	Delivery Time (Days)	Unit	Unit Price
Complete Systems					
1	Dynamic Curve Warning LED Sign System (3 lines of 12" characters, 8 characters wide)	4361	90	Each	$ 9,400.00
2	Dynamic Curve Warning LED Sign System (3 lines of 18" characters, 8 characters wide)	4574	90	Each	$17,450.00
3	Solar Power System (Power System for Item 1)	4575	90	Each	$ 4,900.00
4	Training (include all Daily expenses in unit price)	N/A	14	Day	$ 500.00
Spare/Replacement Components					
5	Radar Unit	3760	14	Each	$ 1,000.00
6	Solar Panels	3276	14	Each	$ 525.00
7	Solar Charge Regulator	3277	14	Each	$ 705.00
8	Sign Controller	3655	14	Each	$ 2,048.00
9	Sign Ventilation Filters	N/A		Each	N/A
10	Sealed Gel-filled Batteries	N/A	14	Each	$ 395.00
	Percentage Discount off of List Price of Related Misc. Items			%	25%
Related/Spare Parts					
11	Character Panel 12"	3875	14	Each	$ 400.00
12	Character Panel 18"	3495	14	Each	$ 562.00
13	Ambient Light Detector Board		14	Each	$ 105.00
14	NTCIP Controller Assembly		14	Each	$ 1,800.00